

Transition in Central-European RTDI systems

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In this paper, the authors wish to discuss some characteristics of the transition following the political transformation of 1989-1990 in Central Europe. The conclusions are supported by empirical studies of the authors in the research, development and innovation (RTDI) sector. It is expressed, that the progress of the (re-)construction of the market economy has been experienced in some sectors, also resulting the improvement of efficiency. However these processes are rather differentiated, and have hardly started in other sectors (due to efforts of actors interested in the conservation of the previous status quo). Finally it is discussed, whether European or “global” (American) patterns should be followed though the transition.

1. Methods and goals of the analysis

The roots of the research introduced here reach back to the observation, that statistics measuring the utilisation of knowledge in the European Union reflect a significant back lag – though science, research and Ph.D. education is of global standards – compared to the USA and Japan. This phenomenon was made widely known by the name “European Paradox” in EC [1995]. In Central and Eastern Europe this paradox – as proven by several research projects¹ – is even more radically present than in the EU. The “Soviet” traditions² of the segregation of the research sector and the real economy still present have dramatic effects. While there are really significant publications in several scientific fields, and in some cases even better than before the transformation (or in some EU member states), these hardly affect the economies. Though the technology level of products and services is lower than desirable in a wide range (of sectors, and companies), the utilization of national R&D results is also weak compared to the EU. The radical fall of the number of patents – which was low even before the transformation – has not stopped yet (see figure 1).³ The fundamental cause for all this is the slow knowledge flow, the moderate diffusion of innovation and the weakness of relations between “science” and “industry” (as the social network transferring knowledge – e.g. the “ba” described by Nonaka – Takeuchi [1998] – would be fundamental for the creation and utilization of new knowledge).

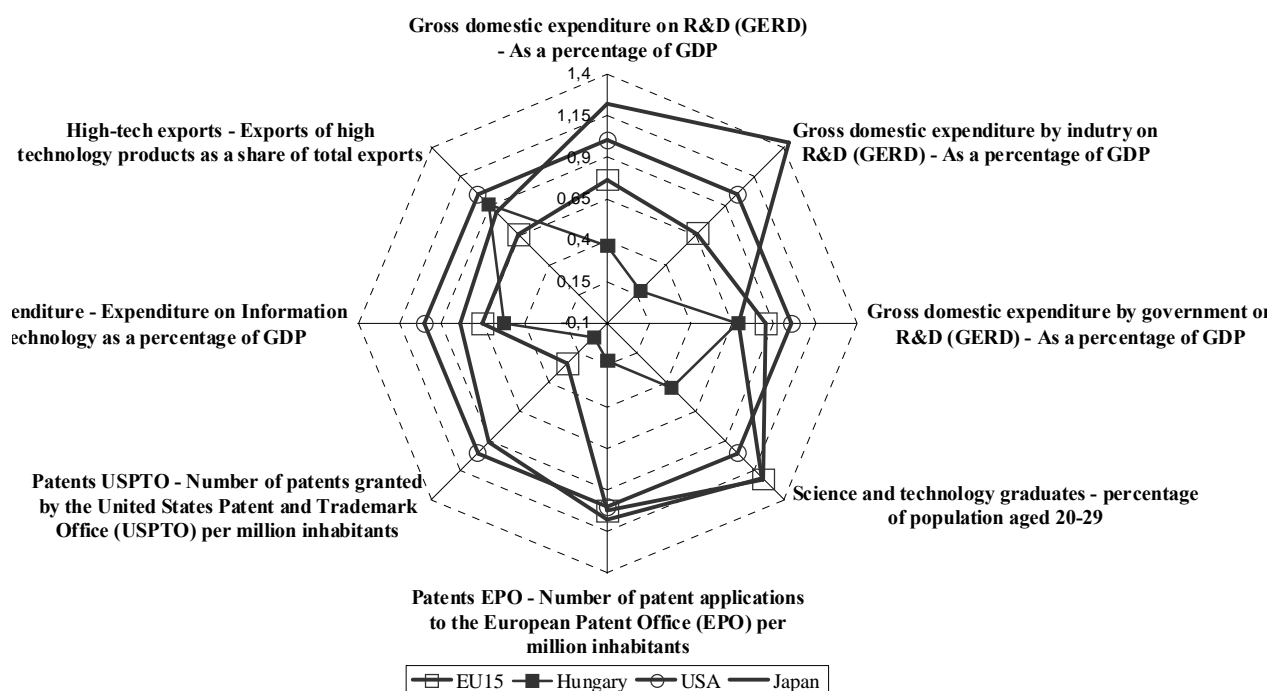
¹ This back lag has been widely known for decades. The first examination of this topic with modern tools however (as far as we are concerned) was performed by Ray [1991]. By that time, the researchers of the region have already discussed the topic (e.g. Papanek [1991]).

² In the past decade several research projects have shown and criticized the “Eastern” European traditions of the rigid separation of research, education and the producing sector (industry). See e.g. section 2 of the volume Dévai – Papanek – Borsi [2002] entitled „Examples of Evaluating R&D in the Candidate Countries” or the article of Kutlaca [2002].

³ The economic effects of this phenomenon are sometimes discussed by Hungarian authors as the “double back lag”.

Figure 1

Factors of national competitiveness in comparison



Source: The calculations of Borsi, B. based on EUROSTAT data

Because of the situation described above, we asked for and have received EC assistance for reviewing this topic. In the framework of the RECORD project⁴ financed by the EC between 2002 and 2005, researchers from nine countries⁵ analysed the performance of RTDI institution – research institutes, universities and corporate research units – of the newly associated countries. First, the suitable **method** of benchmarking has been elaborated (see *RECORD Manual* [2004]). Later, during a smaller, mainly quantitative survey examining approximately 150 research institutions – chosen by national experts based on their excellence – their characteristics were reviewed. Finally about 20 detailed case studies have been worked out (based on a common outline) for the purposes of deeper analysis (see the *RECORD Map* [2004]).

Some experiences of our project show the characteristics of the (re)construction of a market economy in the Central European countries well. Our surveys analysed in fact, how the innovative efforts of research institutes, universities and corporate research units contribute to the generation and utilisation (application and diffusion) of national innovative knowledge. However we did not focus on scientific output measured by publications, but on the capability⁶ of knowledge generation creating value added, and on the **success of the business sector – this unique outcome of the conversion to market economy.** Those institutions were considered excellent, which met the following criteria: their size reached the competitive minimum, their performance resulted marketable innovation(s), and their research results have proven to be commercialized. So the surveys could really outline the significant

⁴ The RECORD (Recognising Central and Eastern European Centres of RTD) project was supported by the EC STRATA support scheme. You may find its main findings in the RECORD Manual [2004] and the RECORD Map [2004] volumes, and the www.record-network.net webpage.

⁵ From Central Europe the researchers of the Czech Republic, Hungary, Malta, Poland, Slovak Republic and Slovenia took part in the project. It was also supported by Austrian, Irish and English researchers.

⁶ The criteria of the successful development of a market economy and its competitiveness – based on Porter [1990] – are evaluated on the basis of its GDP producing capability.

characteristics of the transition process, as they focused on one of the core processes of transition. It was examined whether the wider application of R&D results, and the acceleration of the diffusion of innovations could have been, or could be the engine of the economic development of Central Europe (and Europe⁷) constructing its knowledge-based economy.

2. The differentiation of the transition process

An important conclusion of the RECORD project is that nowadays, the forced separation of “science” and “practice” is no longer general in Central Europe, as there are internationally competitive R&D institutions (commercializing their R&D results and producing significant profit). So, **in some sectors of RTDI the progress of transition is significant**. As Table 1 also shows below, larger research institutions accomplishing major innovation(s) using their knowledge, and commercializing their R&D results on the global market can be found in every country of the region. These institutions were named RECORD *international* centres of excellence. There are also significant RTDI institutions (named RECORD *national* centres of excellence), which developed to be regional centres of “industrial” networks. In the framework of the project, some institutions *specialized on* a few small, narrow “technology” *niches* have also been discovered – e.g. recognized by their technology export – which are undoubtedly internationally competitive.

Table 2

Supposed excellence of the RTDI institutions surveyed* in the RECORD project

Country	International	National	Other RTDI institutions**	Total
	centres of excellence			
Czech Republic	14	24	6	44
Hungary	8	6	11	25
Malta	5	10	6	21
Poland	8	5	12	25
Slovakia	3	5	2	10
Slovenia	8	5	15	28
Total	46	55	52	153

* The “sample” of excellent national RTDI institutions was constructed by national experts.

** There are 2-3 institutions specialized on niches in this group too.

Source: RECORD Map

The research results also highlight however, that the progress of transition in the RTDI sector of the region is far from balanced. Several publications have already drawn the attention to the fact, that differences are not insignificant between these countries.⁸ We have found that **differences inside a country are larger than between countries**. We strove for extending our sample to all institutions considered excellent, however the proportion of RECORD centres of excellence can be considered rather low – at most a few percent of the RTDI institutions operating in the region – based on the data above. The performance of a large number of RTDI institutions (especially of the magnitude of newly founded university research institutes employing 0-1 persons FTE) was ranked even lower. In other words we drew the conclusion that **transition processes progressed rather slowly in the past 15 years in several sectors of the Central European R&D sector falling behind the top performers**. The European integration of the Central European R&D sector on average is slower than the economic integration.

⁷ On the views of the EC, see e.g.: Kok [2004], pp. 6, 11-17.

⁸ E.g. Csaba [2005] (pp. 19 and 25-37) stressed lately, that the economic situations in the region are very diverse despite the common communist past.

Our project gathered specific experience – even characteristic in a lot wider range than the Central European RTDI sector – on the features (and also the causes) of performance differentiation. It has been stated, that the performance of Central European RTDI institutions varies largely by groups according to ownership, scientific field and regional distribution. This is especially important to notice, because convergence derived from the synergies of globalisation (e.g. spreading of entrepreneurial universities, research-based spin-offs) would rather be expected instead of differentiation.

It is characteristic for the benchmarks of R&D capacities, leadership disciplines, human resource management methods, innovative performance, “industrial” relations, financial resources, etc. (listed during the project) that they produce a rather different level of value added in all three traditional segments – **public research institutes, universities and corporate R&D departments** – of the surveyed research institutions. We have found that these three institutional groups all achieved a different development path: they operate under different circumstances, follow different strategies, and there are extreme differences in their relation to politics.

- According to our experience **transition in the corporate sector has – almost – been finished.** The privatization, demolition or liquidation of the mother institutions, the majority of previously governmental research institutions had to face great difficulties. RTDI activities have been halted, reduced, or even restarted by some foreign owners (GE, Volkswagen, etc.). Nowadays however, some “old-new” research institutions of world standard have reached globally important results (again). Some private, small or medium size RTDI firms are also very successful, either spinning out from the mother institution, or having been founded independently.⁹ In this sector (just like in most of the business sectors) there are also market requirements. The effect of demand is strong, profit-requirements cannot be omitted either, and the modern techniques of handling IPRs are spreading too. The practical utilization of R&D results is relatively fast, and the return of expenditures can also be often predicted. Sometimes however progress is strongly halted by regional boundaries of entrepreneurial opportunities (like the lack of capital, the usual violation of the rules of competition, and the unpredictability of the government’s behaviour).¹⁰

Based on a case study e.g. the lighting research laboratory of General Electric Hungary has been considered an international centre of excellence right away, as its research results of high scientific level are applied globally in all factories of the global firm.¹¹ The high scientific level of some long traditional universities and academic research institutions of the regions was registered. Furthermore we highly evaluated two entities in our sample: the performance of two spin-offs following niche strategies – the Hungarian ComGenex Co. selling its products almost completely on the global market, in the field of combinatorial molecular chemistry and the Polis Vigo Systems Ltd. developing and exporting opto-electronic devices.¹²

- In several research institutes of the governmental research institutions – **especially in the research network of the Academy** – high-level scientific results are born nowadays too. There are some, which work according to market principles in many respects. The majority of these institutions however – despite the leaning effect of the lack of sources through transformation crisis – managed to keep their positions (very various in the different countries) and are still not market oriented. The main goal of the majority of researchers is publication. The examination of the research demand of the national economy or “industry”, and the strive for the commercialization of acquired knowledge is scarce, so the national utilization of research results is slow or even falls

⁹ Similar statements have been made previously by X. Richet. See: *Guerraoui – Richet* [2001], p. 23.

¹⁰ Many experts favouring a shock therapy thought, that institutions of control guaranteeing the development of an efficient market after the rapid creation of private property (such as privatisation) would evolve automatically. However *North* [1998] questioned these hopes, as the difficulties of law enforcement in Central and Eastern Europe have proven to be rather strong.

¹¹ *Borsi – Papanek – Papaioannou* [2003], pp. 179-181.

¹² *RECORD Map*, pp. 53-64, 113-120

off (and in some cases diffusion to abroad is faster than inland). The latter opportunities are supported by the institutional background which is often in close contact with politics, and requests / receives significant subsidies.

The Centre for Molecular and Genetic Biotechnology of the Czech Academy of Sciences is an example of academic institutes following a market economy scheme. It aims to accomplish biotechnology research, the promotion of the application and education of research results, and the founding of spin-offs. Its member institutions acquired a high prestige, and their revenues from their innovations are as high as millions of Euros (*RECORD Map*, pp. 34-43). The Slovenian National Institute of Chemistry also having academic roots supporting the production of several companies in pharmaceutical, colour, food, etc production industries accomplishes high level research and contributes largely to the national GDP as well as the living standard of the population (*RECORD Map*, pp. 142-153). The research units of some educational institutions examined however still receive financing primarily through the normative institution-financing system of the governments, and sometimes even consider the commercialization of their research results to be in vein.

- A large number of RTDI institutions were born in the *higher educational sector* previously specialized almost only on education. Where the principles of the entrepreneurial university were accommodated by their management, their economic performance can become significant and the number of spin-offs is also growing slowly. Most of these are however small, often employs only 1 person FTE, and does not have a significant performance. The only explanation for the existence of some of them is the fact, that the “firms” receive central resources – based on the number of students educated in the mother institution. Some further institutions acquired a status similar to the one of the academic institutions (only aims scientific performance, builds up strong governmental connections, etc.)

As Malta also joined the EU in 2004, we had the possibility of reviewing the practice of a small, but modern entrepreneurial university (University of Malta), which researches “industrial” problems and commercializes its results (*RECORD Map*, pp. 74-81). It could also be stated, that the Faculty of Cybernetics of the Czech University of Technology also promotes the practical application of its research results by supporting a wide range of industrial connections (*RECORD Map*, pp. 25-34). Some Eastern European universities – breaking the traditions continued in others – also strive for such a role. However we could also find institutions of higher education rigidly rejecting such changes.

There are also large differences in the distribution of RECORD centres of excellence according to scientific fields and geographical regions. We shall discuss this problem later on.

We already wish to stress here, that according to our experience, the segregation of the Central European RTDI sector described above (as well as the benchmarking technique discovering it) characterises the transformation processes in the other sectors of the examined economies well too. This differentiation is however sometimes a source of severe difficulties, and largely lowers efficiency.¹³ **In sectors, where the previous circumstances are conserved, the slow knowledge flow sets technology development and the spread of social innovation – and so the catching up – back even stronger.**¹⁴ So it is inevitable to take this diversity into consideration both when examining the situation of economies (setting up the diagnosis) as well as the elaboration of the therapy when formulating the – e.g. economic political – suggestions.

¹³ On the importance of economic cooperation see e.g.: *Plunket – Voisin – Bellon* [2001].

¹⁴ The role of innovation in the development of national economies is acknowledged by most of the publications of the past 50 years (e.g.: *Nelson – Winter* [1982], *Dosi* [2000] etc.). The key importance of social - especially management – innovation is highlighted by *Drucker* [1985].

3. The best practice supporting the progress of transition

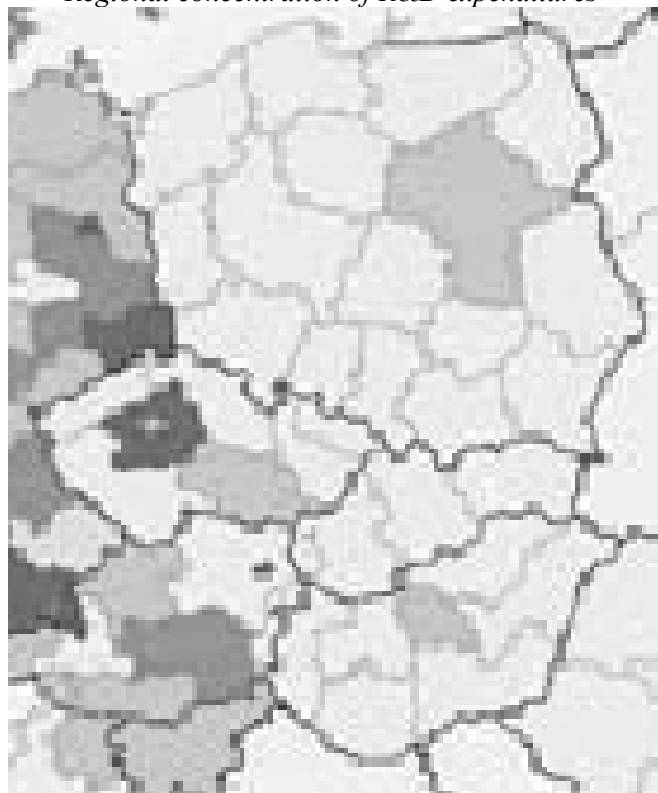
The RECORD project – as well as every benchmarking – had the basic role **to discover** and to analyse the “good”, “**best**” practice of the RTDI institutions found to be excellent (the so called RECOD centres of excellence). We found this survey to be rather important as literature only exceptionally handles the question how the R&D sector of the region can integrate to the European Research Era apart from a few statistics related to the Framework Programmes (see e.g.: *Schuch* [2004])). So we thought it would be desirable to get informed about the catching up opportunities of the research institutions in the region – and to inform experts interested in our findings.

The mapping of benchmarks pointed out first of all, that even some Central European research institutions considered competitive could only account for the factors resulting in the creation of their innovative knowledge. As it turned out to be rather useful in discovering business opportunities, we recommend a wide range of RTDI institution the in depth institutional analysis of the processes of knowledge utilization and diffusion. We recommend the same furthermore for institutions promoting the progress of transforming Central European economies (the improvement of their competitiveness) – or of some of their spheres – operating in different sectors.

Considering benchmarks explaining the success of RTDI we wish to express, that the institutions found excellent during the survey expressed, that they could establish the technical background necessary for their competitiveness (including the financing of major investments). They have not signalled decades of back lag in the field of info-communications either. This however does not question Figure 2, describing that GERD is very low in the region, and the catching up process needs financial resources, but it does question, that in many sectors of RTDI the lack of capital is the main break of progress.

Figure 2

*Regional concentration of R&D expenditures**



* The GERD/GDP ratio is over 3% in Central Bohemia, and it is between 1-1,9% in Central Hungary and in the Polish region of Mazowieckie.

Source: Eurostat: *Regions: Statistical Yearbook 2005* (Panorama of the European Union)

The most important (but hardly surprising¹⁵) experience of the RECORD benchmarking is that **human factors, innovative researchers and charismatic leaders** supporting their work **are the most important factors of success** in Central European RTDI institutions. Their selection was made possible by equal possibilities (selection of leaders without considering political notions, respect of knowledge, open career opportunities for young researchers and women) in most of the high performing communities. We also found that success chances were reduced significantly by appointing untalented management over a talented community – following the traditions of the region – or the managers are forced to work with not talented employees.

Case studies prepared during the survey in two smaller research institutes (ComGenex and Vigo Systems) both highlighted, that these firms would probably not even exist without the charismatic leader founding them, and would never have turned successful. However researchers providing information evaluated the role of talented managers high in several, larger institutions as well.

A further important result of the project is that **modern** management as well as human resource management **methods** are widely applied in the surveyed institutions – and applied even more within successful institutions. So it can be very successful and recommended for managers to reconsider the traditional approach to the missions of their companies (as it is important not to set the accomplishment of scientific results, but their utilizations as a goal regarding business success). Strategy development is also spreading. Project management is applied often too. There is career management in many institutions, several ones help the initial accommodation of their new employees, and education, conference participation, training, of their present employees. Almost every institution promotes mobility and researcher experience exchange, etc. There are no prohibited research topics. So we can conclude that they do not need methodological assistance.

Being familiar with the mother institution, it is not surprising, that General Electric Hungary employs high-level methods of HR management as well. This is also natural in the highest-level universities, academic research institutions of the region. However it is remarkable, that some institutions from far not successful in terms of business also follow the same practice.

Our surveys – in accordance with international experience¹⁶ – have shown “**industrial**” **relations** to be a rather successful method of business excellence. It is also no wonder that smaller corporate research institutions¹⁷ considered excellent tend to build up relations towards the small and medium sized enterprise sector. In the other spheres such activities were only recognizable in **only the most excellent centres** of the regions (as great university-academic research institutions fairly live on the large company sphere, or international contracts.) We have found that the “academic” approach expressing the outstanding importance of basic research is still widely spread. Practical application, consumer needs are not considered important, and nor is knowledge exchange between research institutions and production, etc. Patenting is obviously neglected in almost all Central European research institution, which clearly points out the exceptional nature of “market influencing” efforts aiming the dissemination of scientific results (as according to further experiences of the project knowledge dissemination does not necessarily accelerate with the publication of research results.) And a hardly acceptable cause for this is – apart from some large multinational companies and some rather knowledge intensive public services (e.g.: nuclear plants) – that corporate demand for R&D is weak.

¹⁵ This statement is stressed strongly literature. See e.g.: Collins [2001].

¹⁶ According to Rush – Hobday – Bessant – Arnold [1996], most of the resources in the best research institutions in the world come from revenues generated by high level services (consulting, expertise, testing, etc.) based on knowledge.

¹⁷ This practice concentrating on intra-company relations experienced in the largest global companies – necessarily consisting of numerous small entities – hardly contradicts to our conclusions.

Entrepreneurial universities mentioned above – like the Faculty of Material Sciences and Engineering of the Technical University of Warsaw (*RECORD Map*, pp. 92-102) etc. – e.g. often discovered research tasks by surveying practical needs. They often learned (and made scientific conclusions) from the experiences of their “industrial” partners. But these relations also helped the diffusion of scientific results largely.

We would like to point out, that some international experiences have found industry-research co-operations to be extremely successful if organized in networks like regional clusters. However this process has hardly started in Central Europe.

It is probable, that e.g. the corporate sphere evolved surrounding the Centre for Molecular and Genetic Biotechnology of the Czech Academy of Sciences, or the Hungarian Cereal Research Non-Profit Company are predecessors of such a cluster (*RECORD Map*, pp. 34-43, and 65-72).

Finally we need to mention, that some “*external*” *factors of success (independent form researchers)* of RTDI institutions have proven to be important. It seems to be important, that institutions considered successful concentrate on a few fields of sciences: engineering, chemistry, physics, biology, medicine and IT. In other fields of science – e.g. in some light industries, catering and especially tourist services – however there are hardly any excellent research organizations (or even research projects) found. This implies, that RTDI specialized in these fields has success chances in our region. We could also conclude, that managers can support the development of their institutions by keeping good contact with the government.

We think however, that certain human factors (e.g. charismatic leaders) are not only in the RTDI sector, but also in general the most important promoters as well as breaks of the transition process. Numerous representatives of the (private-) corporate sector got committed to the market economy. However **a rather strong force holding back transition is the negative interest¹⁸ of collectives and managers** of some sectors. So we consider the wide range social acceptance of market economy principles and practice as well as the development of institutions¹⁹ enforcing them to be the most important factors of transition.

4. Future scenarios of transition

On one hand based on the facts described above, on the other hand based on international – e.g. Finnish, Irish, or Silicone Valley – experiences of the development of the RTDI sector, the RECORD project attempted to conclude some statements about the future of Central European RTDI institutions. As this attempt focused sharply on a key sector of the whole transition process, we may outline some hypothesis about the perspectives of the whole transition itself.

Our starting point is that **rather various scenarios of transition can be determined depending on the economic political environment of the processes.**²⁰ We are quite sure, that economic policy – especially focused on the market economy – can make rapid catching up possible. After the historical

¹⁸ Three characteristic groups of this sector are the untrained, mostly unemployed labour “reserve”, the aged intellectuals speaking no foreign languages, and some groups from the earlier political elite who were able to take an advantage of their social networks during the privatisation.

¹⁹ So I agree the conclusion of *de Soto* [2001] saying, that nowadays the most important prerequisite of economic development is probably the existence of general and fair institutions, which are the foundation of the market economy.

²⁰ Though scenarios can also be prepared on different versions of the global economic situation, in the following we only examine factors, which can be influenced by Central Europe.

events of the past 15 years the realization of different development paths can also not be excluded in some countries of the region.

Discovering the possibilities of the promotion of transition processes (and drawing the possible policy conclusions) was one of the important tasks of the RECORD project. We formulated two groups of recommendations. We differentiated the possibilities of the *regional* development and *government* economic policy.

1/ The project results have shown, that the promotion of **regional development is (also) crucial in respect of the future of the RTDI sector**. The actual (geographical) mapping lead to important conclusions. Based on Figure 3 we could state, that the spatial distribution of RECORD centres is not balanced, most of them are in the capital cities of the examined countries. A larger area reaching from Gdansk, through Prague and Bratislava, to Budapest is known as the “red” boomerang.²¹ In the same time however, there are hardly any research units in many of the – NUTS2 – regions in the area. We found that there are only 2-3 international and some national (in other words minor) centres of excellence in the regions Prague, Central Hungary, Mazowieckie (around Warsaw), Bratislava and Slovenia form the 36 regions of Central Europe.

The described geographical characteristics also appoint a way for the innovation policy. In the economy of the age of globalization, some regional connections become the key factors of the generation and diffusion of innovative “knowledge”. These behavioural patterns have not even become general in the EU either. These connections are the cooperation of research institutions settled in the region and the – small and medium size – enterprises, the knowledge flow between them, and the creation of clusters. Just like experienced in the Silicone Valley or in the industrial area of Northern Italy, the network of (small and medium sized) enterprises offers an excellent social environment – a so called “ba” – for the creation of new innovative knowledge as well.

2/ However both for innovation in Central Europe, both for the development of the national economies in the region, **a stronger economic political support of RTDI processes would be important**. We cannot forget e.g., that according to some international (like Finnish) experiences the development of education can (also) be the key to the success of the market economy in the longer run. So we consider the market (practice) orientation of education in Central Europe important. However we think, it is dangerous if governments try to save money on graduate or post-graduate education (e.g. limiting possibilities for attending primary education or determining a wage level inspiring good teachers, professors to leave the education sector, etc.)

We consider one experience of our survey even more important: the underdevelopment of management practices in Central Europe may hide potential reserves for economic policy to help transition. Among the government owned RTDI institutions, the development of the market economy can be promoted by e.g. the appointment of managers based on specialized knowledge and managerial skills, institutional financing systems considering market performance, etc. In further sectors of the economy, the desired social changes can be also supported by similar actions.

In the same time, we experienced **governmental subsidies** to have quite a different role in financing excellent research institutions in the examined countries (perhaps somewhat more in the Slovak Republic and Poland, and less in Hungary). We could state, that the system of proposing for resources in the majority of countries in the region, and regular post-control in the Czech Republic and Poland largely contribute to the efficiency of these subsidies. However we have also found it obvious, that there is no technique, which could stop some subsidised institutions to feel the needs of the business sector to be of secondary importance, or not to let lobbying institutions receive subsidies regardless their performance. So we do not think that governmental subsidies are the most important promoters of progress either.

²¹ See: Gorzelak [1996] regarding the phrase.

Figure 3

Location of RTDI institutions surveyed in the RECORD project



Legend:

	Mathematics and software research		Other engineering
	Physics		Other engineering research
	Chemistry		Medical and related research (except pharmaceuticals)
	Geography and environmental sciences		Pharmaceuticals
	Biology		Agriculture
	Electric engineering research, electronics and telecommunication		Economics
	Energetics		Other social sciences
	Chemical engineering research		

Source: RECORD Map [2004].

Finally we can put up, that **none of our above mentioned two conclusions is valid only for the RTDI sector.** On one hand we think that just like all over the world (*Krugman* [1991] etc.), the acceleration of regional development is an inevitable element of the progress of transition in Central Europe. Considering desirable progress, we need to evaluate the present borders of the regions, usually smaller²² than desirable, not reaching over national borders. A more effective division of labour would be desirable in many cases, on one hand between the elements of regional, on the other hand between other public administrative institutions (e.g. counties). The extent of the specialization of regions should also be analysed. As there are many regions in Central Europe, which have no settlement capable of fulfilling the role of a regional centre, sometimes an intensive centre-development is inevitable. The knowledge-“base” (especially the universities operating in the centre) need to be strengthened in regions specialised in high-tech. This all has to be included in the framework of the National Development Plan, etc.

On the other hand we are quite sure, that – e.g. applying the recommendations of the Lisbon strategy – national economic policies should be made more entrepreneurial and innovation friendly. We cannot forget however the finding of *M. Olson* [1982] and other authors, that market participants and governmental actors have different approaches to the economic policy to be followed. According to sociological surveys (e.g. *Kornai – Rothstein – Rose – Ackeman* [2004]) most of the post socialist societies do not have the “trust” (social capital) necessary for elaborating an economic policy favourable for the whole community.²³ So we think only efficient assistance from the EU can result in hopes for progress in this field.

We also have to recognize, that some of the tasks described above are not parts of the European, but the global best practice. This is especially true for R&D – e.g. the deployment of a larger proportion of research projects to companies, the spread of entrepreneurial universities, the growing role of regional clusters of SMEs in innovation, etc. The integration of Central Europe needs much attendance in these questions. Neither the EU, nor the accession countries can forget that a common goal in this case is the accomplishment of tasks needing changes to be implemented in the member states as well. That is the elaboration of a common future is to be realized instead of transferring the present EU practice.

From all this, various future scenarios can be drawn for the RTDI institutions and national economies of the newly associated counties. Namely:

- The preservation, or perhaps further improvement of efficiency and competitiveness can be expected from those institutions, which are operating as (mostly privatized or newly founded) corporations. So this sector is expected to catch up relatively rapidly.
- The future of RTDI institutions (networks) remaining in governmental hands – despite their inevitably high scientific levels in a wide range of fields – can be considered more insecure. Two alternative development paths can be drawn for these institutions (and their management). Some have already started adopting market economy model(s), and strive for the economic application of their knowledge, and aim to achieve financial resources available in this manner. The business success of the EU integration of (at least the majority of these) institutions capable of showing such progress can be predicted. However a darker prediction needs to be given for those institutions not considering market economy requirements, relying on governmental subsidies. This population of institutions runs for the achievement of EU resources with a disadvantage as well, and can expect that tax payers will be less and less willing to finance R&D showing no return for the community as well. So their marginalization is hardly inevitable (because of the emigration of their young and talented colleagues abroad or to other institutions, etc.)
- A favourable prediction can be given, and the fast progress of transition can be expected in those economies, where the development of regions has accelerated (real centres were formed, where

²² According to literature, at least 3 million inhabitants and 150 thousand high-tech employees in regions with high-tech industries are necessary for a competitive region. (*Varga* [2004], p. 269).

²³ Perhaps it is no coincidence, that the leaders of transition in Central Europe are Estonia and Slovenia – two countries, which have not inherited a governmental apparatus from the command economy era.

the regional institutional background has strengthened, the directions of regional specialization have been clarified, and the clusters representing this specialization have been formed, and so several RTDI institution turned competitive, etc.) – and a really entrepreneurial friendly economic policy is in effect. In the past decades several countries with these characteristics (e.g.: Finland and Ireland) succeeded in both the integration of their RTDI sectors to the ERA as well as in the catching up of their economies.

- Those Central European economies, where the previous practice can only slowly be altered, have explicitly unfavourable chances. In countries conserving their low level of technology and efficiency, even the present position of the producers can be endangered by competition from the Far East. So these societies shall draw the dynamism of the EU back, unless the Community effectively supports their social transition.

It is not questionable however, that the future scientific and economic centre of the EMU – and the EU – will be in Western Europe in the future, just like presently. The – slow – widening of the ERA network is expected towards Berlin-Prague and in the direction of Vienna, Bratislava and Budapest based on the experiences of the RECORD project (and the theories of other authors, like the “red octopus” by Meer [1998]). The Austrian and northern Italian connections of Slovenia are also promising. We can only hope that the eastern widening of the ERA will be a parallel process to the economic catching up of this region.

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